Baghouse safety: best practices for hands-on maintenance

From Canadian biomass
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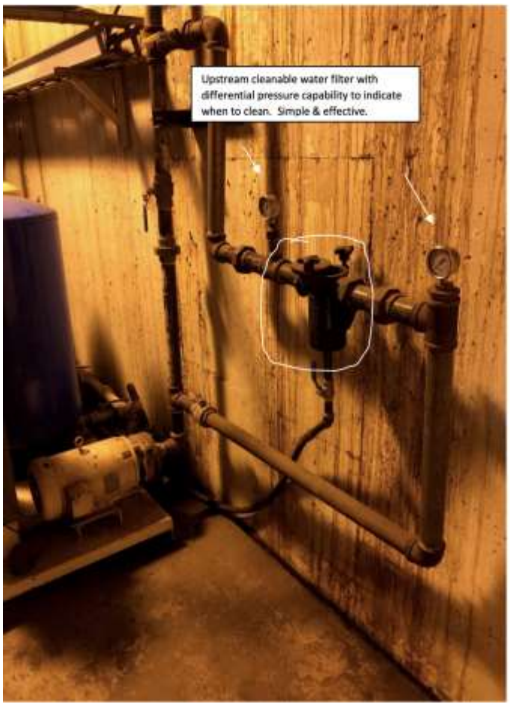
Baghouse maintenance can be quite complex and involve many trades from power engineers, millwrights, electricians, instrumentation technicians and contractors. The results of proper maintenance can yield a well-running, efficient and safe fines collection system (baghouse) that will enhance productivity and plant uptime.

Based on personal experience from inspecting plants all over North America, many different aspects of maintenance are often overlooked. The following list highlights the low hanging fruit of opportunities:

1. **Fire protection water source quality and quantity is very important.** A good fire protection maintenance program closely monitored by a company's insurer will pick up on foreign debris contamination such as shrimp, frogs, mud, scale and leaves. This foreign material can clog baghouse fire protection valves, solenoids, strainers and sprinkler spray nozzles. Fire ponds are especially bad for this. Removing nearby trees or shrubs will help alleviate this problem. Alternatively, installing an upstream filter will also help keep contaminates out of the fire protection water. Inspecting and recording fire pond levels is also very important to ensure a plant doesn't get caught with their pants down and does not have enough water in the event of a major fire, which could drastically affect how an insurance claim is processed.

No foreign debris

Foreign debris



Upstream cleanable water filter with differential pressure capability to indicate when to clean. Simple and effective.

2. **Regular fire protection systems [equipment inspections](#)**: Inspect spark detection sensing eyes that may be dirty, worn or incorrectly installed, resulting in a spark not seen at all that could eventually end up inside your baghouse and cause a fire or explosion.

Dirty sensing eye.

Clean sensing eye

This sensing eye was found dirty and had fallen out of its home, just hanging over the handrail. No light was seen because of the dirty eye.

Water supply line to deluge nozzle in-line strainer requires frequent cleaning, otherwise water flow could be reduced or blocked. Note: this strainer was leaking due to damaged threads.

Worn nozzles can also plus as fines material enters the nozzle itself.

3. **Baghouse mechanical inspections:** Baghouses have a number of components that make up its functionality. One such item is a puffer blower, which continually builds up air pressure via a positive displacement blower. Regulations require that any positive displacement blower has a pressure relief valve (PRV). Over time, the springs on the PRV can become weak and as the pressure builds up in the receiver to approximately nine psig, the PRV will start to lift prematurely, affecting how efficiently the bags are "puffed" or "cleaned," if at all. The result is a fairly rapid increase in baghouse system differential pressure and loss of suction at the critical material pick-up points, and can result in a fire at the pick-up point or saws. Another point is the timing of the solenoid valve in the baghouse HMI programming. There have been instances where the commissioning has missed setting up the solenoid timers. Typically, they are set to cycle when the puffer pressure reaches nine psig.

Placing a gloved hand over the discharge of the PRV will indicate if the PRV has a weak spring and is bypassing. This check should be included in the regular PM.

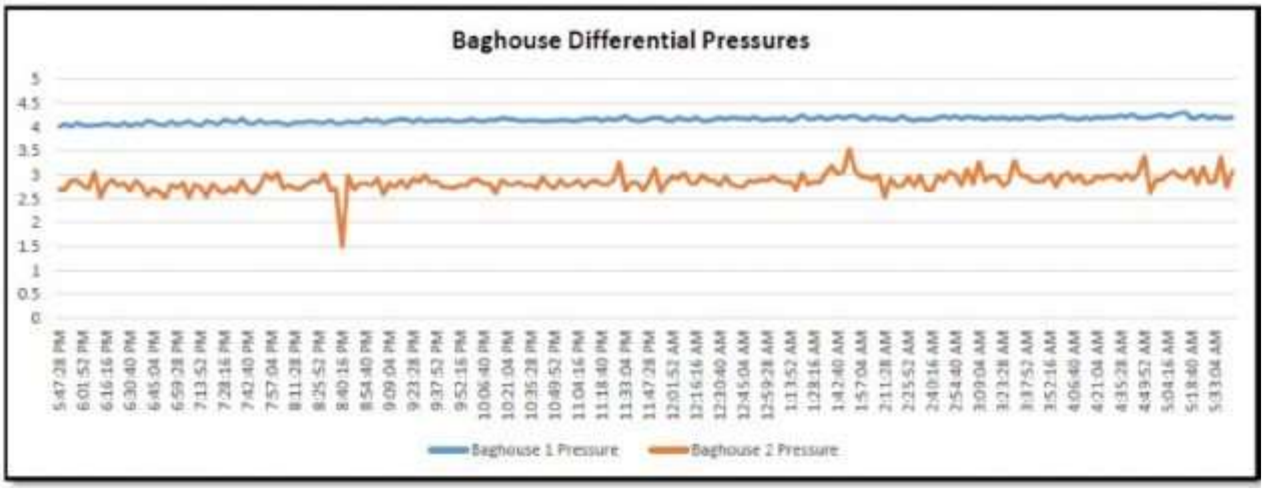
The puffer blower also has an inlet filter that needs to be checked and cleaned on a regular basis. I've often found the inlet filters plugged or the fastening nut completely gone, such as the example in the below picture. If the filter is plugged, it will reduce the airflow at the puffer inlet and extend the time it takes to pressure up to the nine psig, resulting in the puffer releasing the air or "puff" into the bags at a lower pressure. If the filter is being bypassed, as in the case of the missing fastener nut, dust may be pulled into the airstream and cause the solenoid valve activating the puffer to fail and no puffing will happen at all. The result will be loss of suction at the material pick-up point and potential fire.

Missing fastening nut results in a poor seal.

4. **Baghouse differential pressure photohelics**: Calibration checks should be done at least annually. Over time, the sensing lines can become plugged or the lines can become brittle and crack. I've also seen these lines inadvertently disconnected and never put back in place. These photohelics are often tied to alarm thresholds that will alert a control room operator that the baghouse bags are potentially plugging. Often when an alarm comes in, it is silenced, ignored or a field technician is asked to go adjust the alarm threshold up and then it is often left for the next shift or forgotten about completely – until the bags plug, suction is lost at the pick-up point and a fire ensues, resulting in production losses.

An example of a photohelic that has had the alarm threshold increased above 5"WC.

5. **Baghouse pressure monitoring**: Best case scenario is to have the baghouse differential pressures electronically monitored with alarm thresholds and have key point indicators (KPIs) set up to be reviewed by the management team every shift.



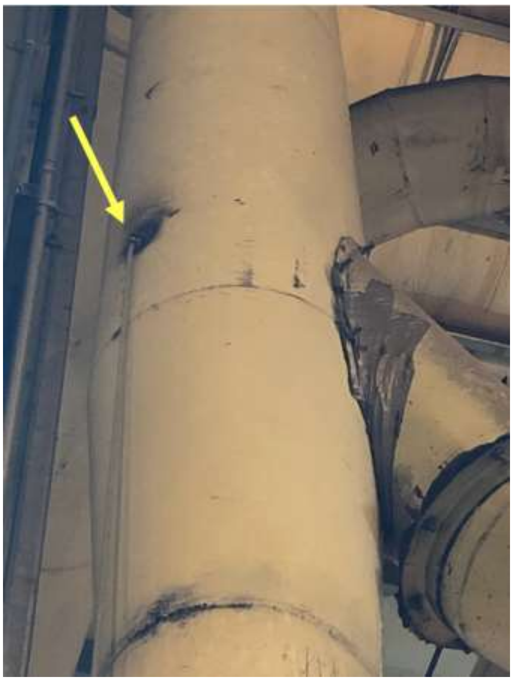
6. **Baghouse airlock feeder**: This often-overlooked piece of equipment can run for a long time before someone notices that the airlock vanes have become worn resulting in positive pressure above the rotary vanes, which can cause bridging and baghouse material discharge plugging. A common early precursor to this is when a power failure occurs – the baghouse often will show a plug indication immediately afterwards and will require manually unplugging of the baghouse. This is a very unpleasant and potentially unsafe procedure, as many of my colleagues can confirm. The result is usually extended and unnecessary production loss.

7. **Baghouse implosion protection damper**: Often baghouses will have implosion dampers in the inlet of the main fan for the possibility of a second-stage Grecon spark detection that will activate a fire abort damper, redirecting the potential spark away from the baghouse and activating an emergency shutdown safety interlock. This implosion damper protects the ducting from the baghouse back to the pick-up point from collapsing inwards from too much negative pressure. In the case of the below picture, if the baghouse's main fan sheaves have been changed out due to wear or in an effort to speed up the fan to produce more suction (often a band-aid solution) this implosion damper will open – inadvertently reducing the suction again at the pick-up point. Hence, the added weights and bungee cords. With this practice, the suction piping often will Implode over time from second stage sense and abort events.

8. **Poorly engineered applications**: In the case below, the baghouse main fan is pushing the airflow into the baghouse rather than pulling it through. The problem with this application is that there is no way to accurately measure the differential pressure across the bags to determine and schedule a bag change out. In this application, the inlet pressure to the baghouse is only measured, which is not as accurate as measuring differential pressure. The Grecon fire protection sensing eyes and deluge nozzles are also not as effective due to poor placement.

9. **Suction line system balancing**: Proper commissioning of baghouse systems includes air balancing the many and multiple pick-up points. Over time, pick-up points are added or replaced/repaired. In the case of the below picture, there was a section replaced due to wear and the balancing damper was found completely closed. This affected the entire system and resulted in multiple plugs in multiple locations for months, resulting in unwanted production losses and very frustrated maintenance crews.

10. **Baghouse Magnahelics**: A good practice is to install Dwyer brand Magnahelics at key locations at suction pick-up locations. This is a good visual representation of what normal suction is. If the gauge is checked regularly and religiously every shift, often a problem can be picked up early before any fires or production upsets occur. A sawline operator will be worth his weight in gold if he/she checks this gauge often. In one case, the pick-up lines were plugging randomly for a week before it was discovered a clean-out door in the upstream ducting was left open from the previously scheduled maintenance day. This Magnahelic gauge was reading low and no-one questioned it.



11. **Worn suction hoods**: Worn suction hood brushes or improvised brushes will cause airflow efficiency loss and will not properly take the material away effectively. This will lead to plugged saws and eventually a friction fire and unwanted and unnecessary production losses. A note of caution here: Often to reach production targets, time is not given to the maintenance teams to properly repair these items or the maintenance budgets have been cut to meet targets.

12. **Instrumentation**: Proper instrumentation installation can increase production reliability in that stainless-steel lines will not harden and split or crack over time and will last for many more years. The fittings typically seal better as well.

Example of poor installation.

Example of proper installation.

In summary, I could write a book about the multitude of maintenance and operational issues experienced over the years and I haven't even discussed the NFPA regulations. There are too many to list in this article anyway. If your company could use an inspection and audit report, please contact Cariboo Biomass Consulting services at your convenience at www.cariboobiomass.ca or Kevin Ericsson at info@cariboobiomass.ca.